Evita 2 dura CapnoPlus™

Addendum to
Evita 2 dura
Operating Instructions

1-256-96

NOTICE

Proprietary Information

This document contains information in which Draeger Medical, Inc. claimed proprietary rights. The information may not be reproduced in whole or in part except as authorized in writing by Draeger. This information is the property of Draeger Medical, Inc., it is provided solely for the use intended.

Repairs/Modifications

Repairs on this device shall be performed only by DraegerService or its Authorized Service Centers. Information about repairs can be obtained from Draeger or Authorized Dealers. Draeger Medical, Inc. will not be responsible for injury to persons or damage to property arising directly or indirectly out of unauthorized repairs or modifications to this device. Furthermore, any unauthorized repairs or modifications void any warranty extended by Draeger.

This document is provided for your information only. It will not be exchanged or updated without request.

Trademarks

The Draeger name and logo are registered trademarks of Drägerwerk Aktiengesellschaft.

CapnoPlus™ is a trademark of Drägerwerk Aktiengesellschaft.

Contents

Important Safety Information READ THIS FIRST..... 4
Operator's Responsibility for Patient Safety..... 4
Limitation of Liability..... 4
Warranty..... 5
Definitions..... 6
General WARNINGS and CAUTIONS..... 6
Precautions During Preparation..... 7
Precautions During Operation..... 7
Precautions During Care..... 7
Precautions During Maintenance..... 7

Intended Use..... 8

Preparation..... 9
Before First Use..... 9
Installing Cuvette and CO2 Sensor..... 10
Configuring CO_2 Waveform..... 11
CO2 Calibration..... 11

Measuring CO_2..... 13
Displaying CO_2 Waveform 13
Setting Alarm Limits for etCO_2 13
Switching Off Monitoring Functions 12

Testing/Calibrating the CO_2 Sensor..... 15
Testing CO_2 Calibration With Test Filter..... 15
Testing CO_2 Calibration With Calibration Gas..... 16
Calibrating CO_2 Sensor..... 18
Resetting CO_2 Calibration..... 19

Care..... 20
Disassembly..... 20
Disinfecting/Cleaning..... 21

Troubleshooting 23

Maintenance..... 24
Maintenance Intervals..... 24

Technical Data..... 25

Theory of Operation..... 27
Physiological Capnogram..... 27
Abbreviations Explained..... 29
Bibliography..... 29

Ordering Information..... 30

Index..... 31

Important Safety Information

Operator's Responsibility for Patient Safety

For correct and effective use of the product and in order to avoid hazards it is mandatory to carefully read and to observe all portions of this manual.

The design of the intensive care ventilators this device is intended to be used with, accompanying literature, and the labeling on the equipment take into consideration that the purchase and use of the equipment are restricted to trained professionals, and that certain inherent characteristics of the equipment are known to the trained operator. Instructions, warnings, and caution statements are limited, therefore, largely to the specifics of the Draeger design. This publication excludes references to various hazards which are obvious to a medical professional and operator of respiratory care equipment, to the consequences of misuse of such equipment, and to potentially adverse effects in patients with abnormal conditions. Product modification or misuse can be dangerous. Draeger Medical, Inc. disclaims all liability for the consequences of product alterations or modifications, as well as for the consequences which might result from uses of the product not covered by its intended use or from the combination of this product with other products whether supplied by Draeger or by other manufacturers if such a combination is not endorsed by Draeger Medical, Inc..

The operators of ventilator systems must recognize their responsibility for choosing appropriate safety monitoring that supplies adequate information on equipment performance and patient condition. Patient safety may be achieved through a wide variety of different means ranging from electronic surveillance of equipment performance and patient condition to simple, direct observation of clinical signs. The responsibility for the selection of the best level of patient monitoring lies solely with the equipment operator.

Limitation of Liability

Draeger Medical, Inc.'s liability, whether arising out of or related to manufacture and sale of the goods, their installation, demonstration, sales representation, use, performance, or otherwise, including any liability based upon Draeger Medical, Inc.'s Product Warranty, is subject to and limited to the exclusive terms and conditions as set forth, whether based upon breach of warranty or any other cause of action whatsoever, regardless of any fault attributable to Draeger Medical, Inc. and regardless of the form of action (including, without limitation, breach of warranty, negligence, strict liability, or otherwise).

THE STATED EXPRESSED WARRANTIES ARE IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING, WITHOUT LIMITATION, WARRANTIES OF MERCHANTABILITY, FITNESS FOR ANY PARTICULAR PURPOSE, OR NONINFRINGEMENT.

Draeger Medical, Inc. shall not be liable for, nor shall buyer be entitled to recover any special incidental, or consequential damages or for any liability incurred by buyer to any third party in any way arising out of or relating to the goods.

Warranty

All Draeger products are guaranteed to be free of defects for a period of one year from date of delivery. The following are exceptions to this warranty:

1. The defect shall be a result of workmanship or material. Defects caused by misuse, mishandling, tampering, or by modifications not authorized by Draeger Medical, Inc. or its representatives are not covered.
2. Rubber and plastic components and materials are-warranted to be free of defects at time of delivery.
3. Oxygen sensors capsules have a six-month limited warranty from the date of delivery.

Any product which proves to be defective in workmanship or material will be replaced, credited, or repaired with Draeger Medical, Inc. holding the option. Draeger Medical, Inc. is not responsible for deterioration, wear, or abuse. In any case, Draeger Medical, Inc. will not be liable beyond the original selling price.

Application of this warranty is subject to the following conditions:

1. Draeger Medical, Inc. or its authorized representative must be promptly notified, in writing, upon detection of the defective material or equipment.
2. Defective material or equipment must be returned, shipping prepaid, to Draeger or its authorized representative.
3. Examination by Draeger Medical, Inc. or its authorized representative must confirm that the defect is covered by the terms of this warranty.
4. Notification in writing, of defective material or equipment must be received by Draeger Medical, Inc. or its authorized representative no later than two (2) weeks following expiration of this warranty.

In order to assure complete protection under this warranty, the Customer Registration Card and/or Periodic Manufacturer's Service Record (if applicable) must be returned to Draeger within ten (10) days of receipt of the equipment.

The above is the sole warranty provided by Draeger Medical, Inc. No other warranty expressed or implied is intended. Representatives of Draeger are not authorized to modify the terms of this warranty.

Draeger Medical, Inc., Telford, PA

Definitions

WARNING !

A WARNING statement refers to conditions with a possibility of personal injury if disregarded.

CAUTION !

A CAUTION statement designates the possibility of damage to equipment if disregarded.

NOTE: A NOTE provides additional information intended to avoid inconveniences during operation.

Inspection	**=**	examination of actual condition
Service	**=**	measures to maintain specified condition
Repair	**=**	measures to restore specified condition
Maintenance	**=**	inspection, service, and repair, where necessary
Preventive Maintenance	**=**	Maintenance measures at regular intervals

Typing conventions in this manual

Controls ("hard" keys and screen keys / fields) are designated as »**Control Name**«, e.g.

»**Calib./Config.**«

Screen pages are indicated as »Screen page«, e.g.

»Limits«

On-screen messages are printed in **bold**, e.g.

etCO2 calibration OK.

General WARNINGS and CAUTIONS

WARNING !

Strictly follow Operator's Instruction Manuals

Any use of the product requires full understanding and strict observation of all portions of these instructions as well as the Operating Instructions of the Evita 2 dura ventilator. The equipment is only to be used for the purpose specified under "Intended Use" (page 8). Observe all WARNINGS and CAUTIONS as rendered throughout the manuals and on labels on the equipment.

WARNING !

DANGER, risk of explosion if used in the presence of flammable anesthetics.

The equipment is neither approved nor certified for use in areas where combustible or explosive gas mixtures with air or with nitrous oxide are likely.

WARNING !

Electrical connections to equipment which is not listed in these Operating Instructions should only be made following consultations with the respective manufacturers or a qualified expert.

CAUTION !

Restriction of Distribution

Federal Law and Regulations in the United States and Canada restrict this device to sale by or on the order of a physician.

CAUTION !

Traceability

Federal Law in the United States requires traceability of this equipment. Please return the self addressed registration card included with the product and fill in the required information.

CAUTION !

Accessories

Use only accessories listed in the Ordering Information (page 30).

Precautions During Preparation

WARNING !

Installation of the Evita 2 dura CapnoPlus Option may be performed by factory trained and authorized service personnel only.

Precautions During Operation

WARNING !

In case of malfunction of any of the built-in monitoring a substitute has to be provided in order to maintain an adequate level of monitoring. The operator of the ventilator must still assume full responsibility for proper ventilation and patient safety in all situations.

Precautions During Care

WARNING !

Always follow accepted hospital procedures for handling equipment contaminated with body fluids.

WARNING !

Follow all accepted hospital procedures for disinfecting parts contaminated by body fluids (protective clothing, eyewear, etc.).

CAUTION !

Certain components of the ventilator and its accessories consist of materials that are sensitive to certain organic solvents sometimes used for cleaning and disinfec-ting (e.g., phenols, halogen releasing com-pounds, oxygen releasing compounds, strong organic acids, etc.). Exposure to such substances may cause damage that is not always immediately recognized.
Sterilization with ethylene oxide (EtO) is also not recommended.

Precautions During Maintenance

WARNING !

To avoid any risk of infection, clean and disinfect ventilator and accessories before any maintenance according to established hospital procedures - this applies also when returning ventilators or parts for repair.

WARNING !

Preventive Maintenance work on the Evita 2 dura ventilator and its components may be performed by trained and factory authorized staff only.

WARNING !

Never operate the ventilator if it has suffered physical damage or does not seem to operate properly. In this case always refer servicing to properly trained and factory authorized service personnel.

CAUTION !

Maintenance

In case of malfunction of this device, contact your local DraegerService or our Factory Authorized Technical Service Center.

The device must be inspected and serviced (preventive maintenance) by competent and factory authorized technical service representatives at regular 6 month intervals. A record must be kept on this preventive maintenance. We recommend obtaining a service contract through your vendor.

Maintenance or repair of the Evita 2 dura ventilator and its installed options shall be performed only by Draeger authorized technical service representatives.

Intended Use

Evita 2 dura CapnoPlus – optional mainstream CO_2 monitoring for Evita 2 dura.

– For continuous, real time measurement of CO_2 partial pressure in a patient's breathing gas.

– For measuring endexpiratory CO_2 partial pressure etCO_2.

– For monitoring endexpiratory CO_2 partial pressure etCO_2 with upper and lower alarm limits.

– For calculating CO_2 production.

– For calculating serial deadspace.

Preparation

Installation

WARNING !

Installation of the Evita 2 dura CapnoPlus option may be performed by factory trained and authorized service personnel only.

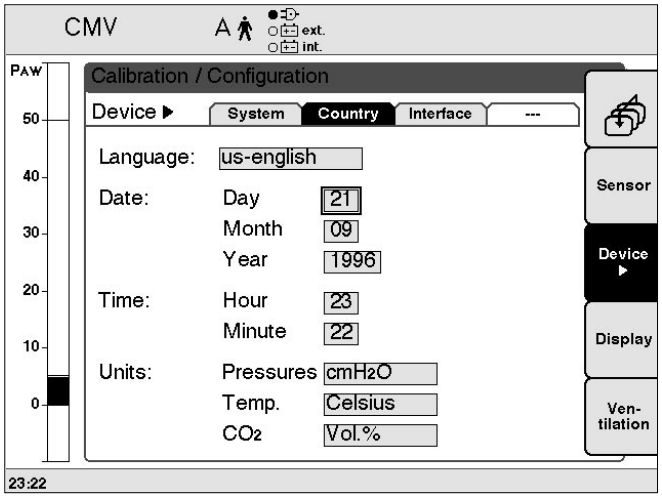
Before First Use

Selecting a unit of measurement for CO_2

At the time of delivery, mmHg is preset,
kPA or Vol% may alternatively be selected.

- Press »**Calib./Config.**« menu key.
- Press »**Device**« menu key.
- With the »**Device ▶**« menu key, select «**Country**« menu.

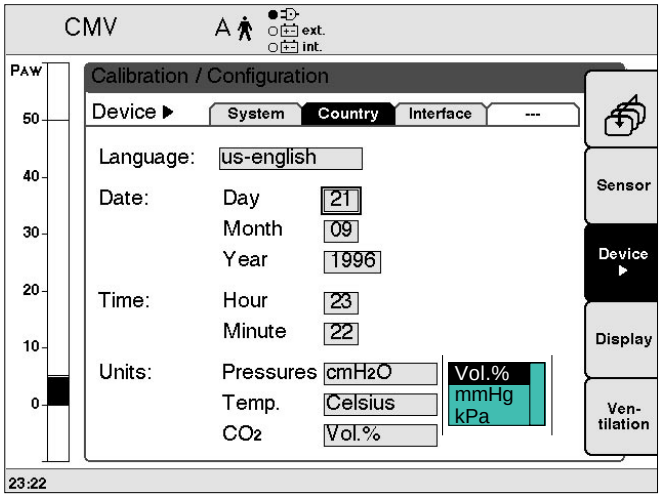
Display (example):



Under **Units**:

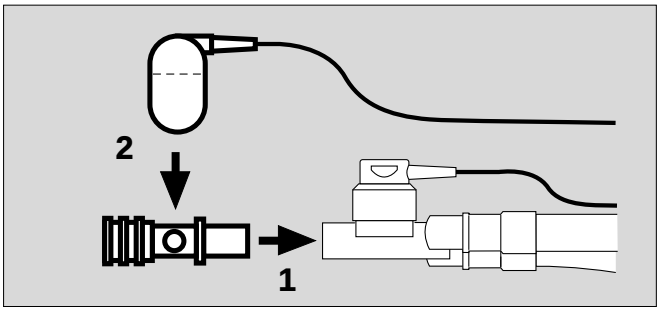
- Select »**CO_2**« screen field = turn dial knob.
  Confirm = press dial knob.
  The list of available units of measurement will appear.

Display (example):



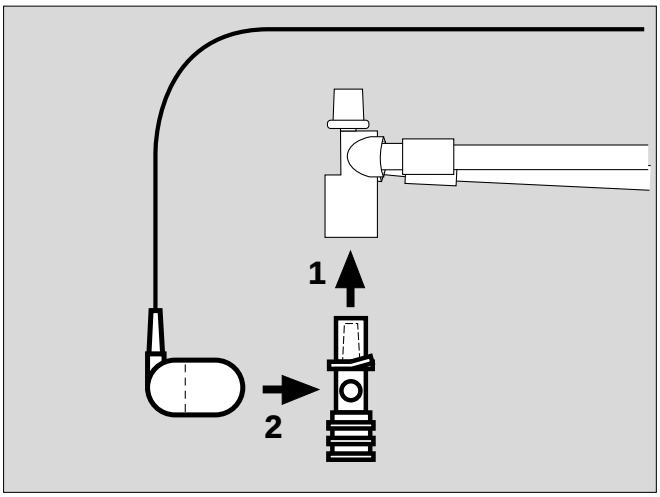
- Select unit = turn dial knob.
  Confirm = press dial knob.

Installing Cuvette and CO_2 Sensor



With an adult patient circuit

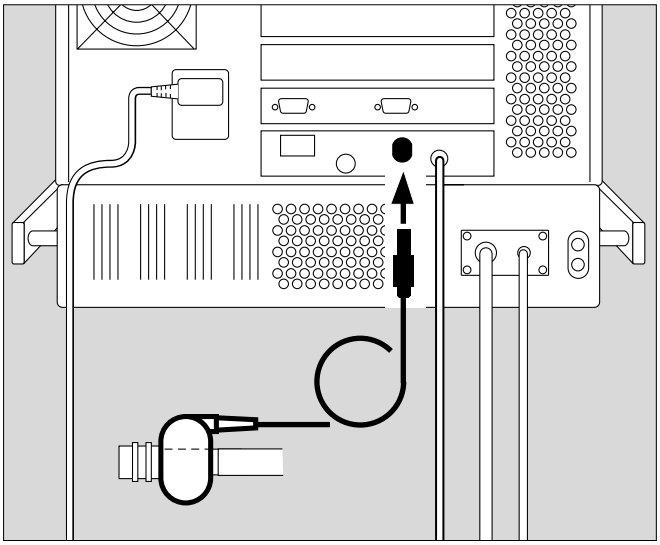
1. Insert cuvette into the patient connection of the wye, with the cuvette windows facing sideways
2. Push CO2 sensor onto the cuvette, with its cable towards the ventilator.



With an pediatric patient circuit

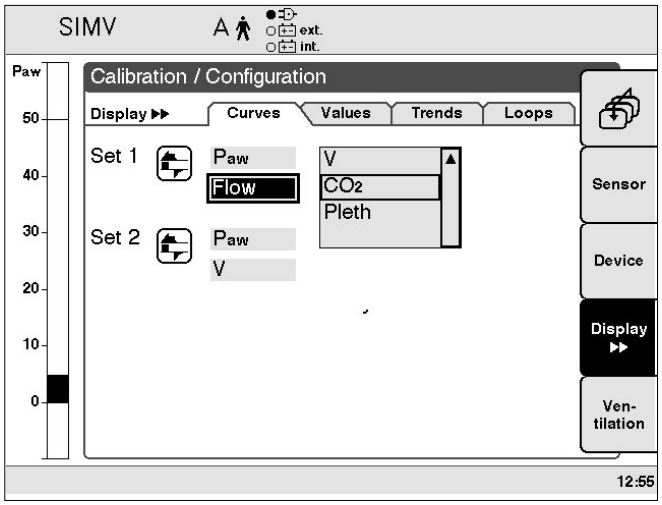
1. Insert cuvette into the patient connection of the wye with the cuvette windows facing sideways
2. Push CO2 sensor onto the cuvette, with its cable towards the wye.

- Insert CO_2 sensor probe connector into the socket marked CO_2 on the rear panel of the ventilator.



Configuring CO_2 Waveform

- Press »**Calib./Config.**« menu key.
- Press »**Display**« menu key.
  The »Waveforms« menu page appears**.**



To replace a waveform display with the CO_2 waveform:

- Select respective screen field = turn dial knob
  Confirm = press dial knob.
  The list of all available waveforms will be displayed on the screen to the right.
- Select CO_2 waveform = turn dial knob.
  Confirm = press dial knob.

CO_2 Calibration

– if the ventilator requests CO_2 calibration with the screen message: **CO_2 calibration?**

– if the CO_2 waveform no longer returns to zero after each expiration

– before each test of CO2 calibration, see page 15,16.

– before each CO_2 sensor calibration, see page 18.

After switching on Evita 2 dura, wait for the 3 minute warm-up phase to be completed, until message: **CO_2 warm-up** has disappeared.

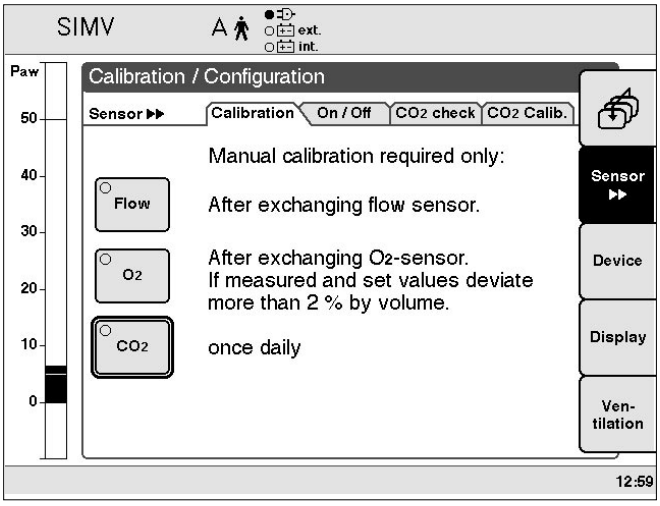
At the beginnign of warm-up, no values are displayed for CO2 (display: 0).

After a few seconds, a minute at the most, the ventilator will be ready for measuring and will display measured values for CO_2.

After approximately 3 minutes, measured values will be within the specified accuracy.

- Press »**Calib./Config.**« menu key.
  The »Sensor« menu page will appear.
- Select »**CO_2**« menu key = turn dial knob.
- Start calibration = press dial knob.

Display (example):

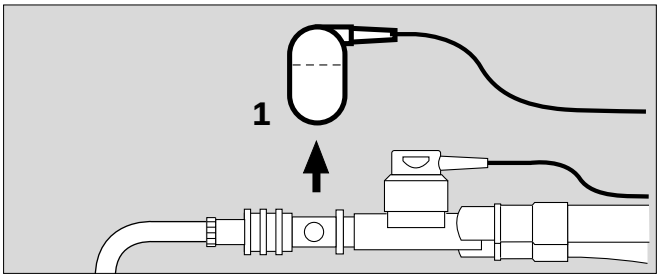


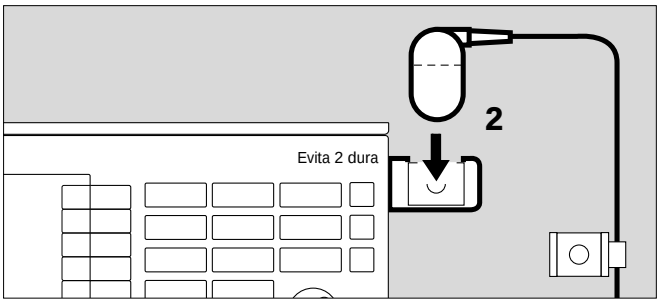
Message:
Park CO_2 sensor. Confirm with ●

1 Remove sensor from cuvette

2 Fit sensor on park bracket.

- Confirm = press dial knob.
  CO_2 calibration is now performed.





Message:

CO2 zero calibration

After approximately 5 seconds, the ventilator confirms:

CO2 calibration OK

- Re-attach sensor to cuvette

The ventilator signals an unsuccessful calibration attempt with the message:

CO2 calibration not OK

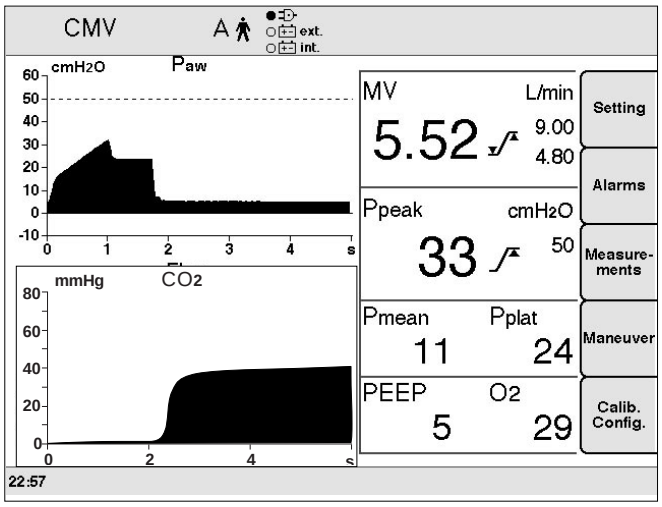
See "Troubleshooting", page 23.

- Repeat CO_2 calibration.

Measuring CO_2

Displaying CO_2 Waveform

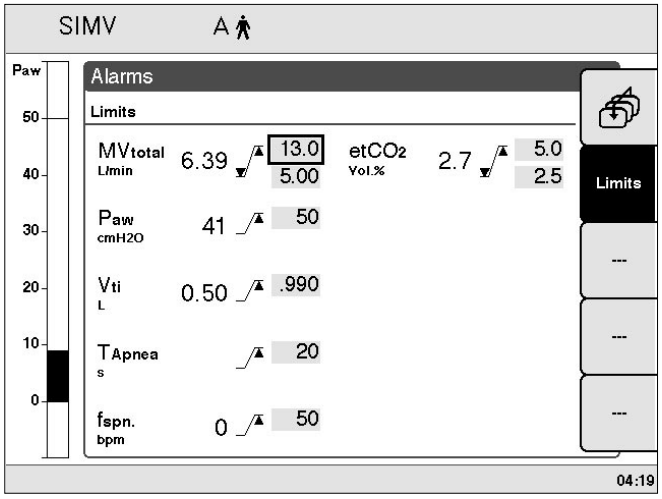
- Press »**Waves**« key.



Setting Alarm Limits for $etCO_2$

Set alarm limits are maintained even when the ventilator is switched off.
Evita 2 dura will generate an alarm if the value for $etCO_2$ remains continuously outside the set alarm limits for longer than 15 seconds.

	Adjustment range	Factory-set start-up defaults
$etCO_2$	1 to 100 mmHg 0.1 to 15 kPa	30 mmHg
	0 to 99 mmHg 0 to 14.9 kPa	60 mmHg



- Press **»Alarms«** menu key.
  The »Limits« menu page will appear
- Set alarm limit with the dial knob and press to confirm. The new alarm limit will now be in effect.

---

* see also Theory of Operation, "Physiological Capnogram, p. 27

Switching Off Monitoring Functions

if CO2 measurement temporarily is not going to be used.

WARNING !

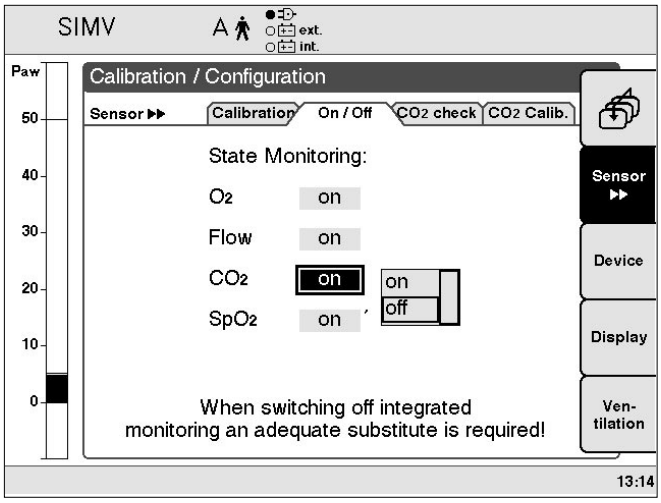
In case of malfunction of any of the built-in monitoring a substitute has to be provided in order to maintain an adequate level of monitoring. The operator of the ventilator must still assume full responsibility for proper ventilation and patient safety in all situations.

Example: Switching off CO_2 monitoring.

- Press »**Calib./Config.**« menu key.
- Using the »**Sensor ▶▶**« menu key, select »On/Off« menu page.

Display (example):

- Select »**CO_2**« screen key = turn dial knob.
- Switch off CO_2 monitoring = press dial knob.



To switch monitoring back on:

- Select respective screen key = turn dial knob.
- Switch on monitoring = press dial knob.

Testing/Calibrating the CO_2 Sensor

The CO_2 sensor is factory calibrated and can be used without further calibration on any Evita 2 dura ventilator. A CO_2 calibration is performed as part of the ventilator check.

Calibration of the CO_2 sensor is only required:

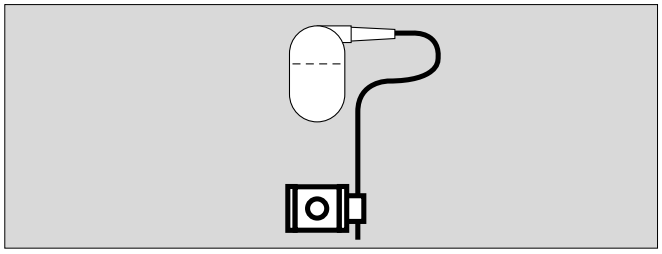
– if, upon checking calibration with a test filter or with test gas, the specified test values are not met

– during the half-yearly preventive maintenance inspections.

The calibration check or calibration may be performed during ventilation.

Testing CO_2 Calibration With Test Filter

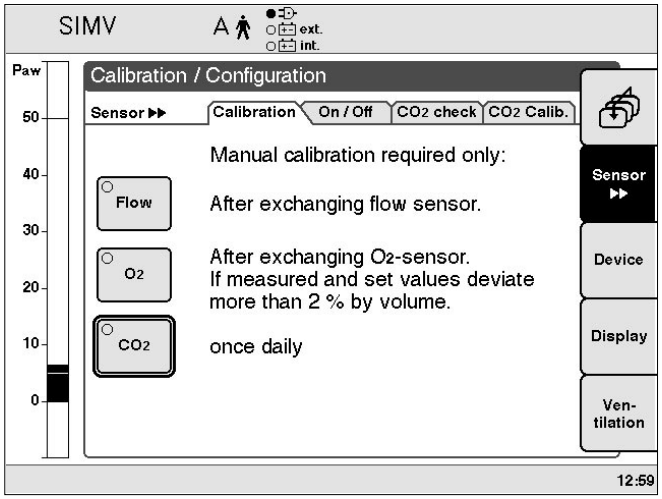
- Perform CO_2 calibration, see pages 11,12.



After the CO_2 calibration:

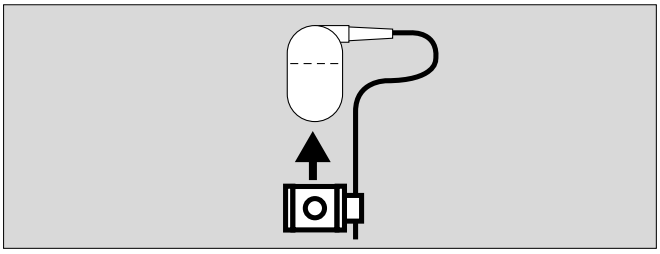
- Press »**Calib./Config.**« menu key.
- Using the »**Sensor ▶▶**« menu key, select »CO2 Test« menu page.

Display (example):

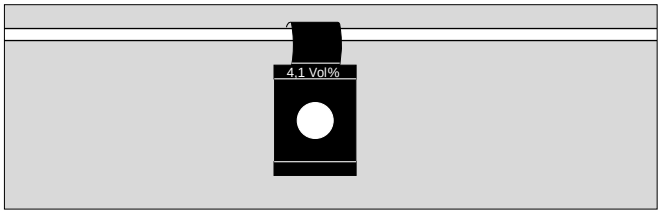


- Activate »**Measure**« screen key = press dial knob.

- Place test filter into the CO_2 sensor.



The screen displays the test value of the CO_2 concentration FCO_2.
This value must agree with the specification on the test filter within ± 0.3 Vol.%.
Example: 4.1 Vol.% on the filter:
permitted values: 3.8 to 4.4 Vol.%



- Push CO_2 sensor back onto cuvette.

If the test value is outside the permitted tolerance, a test with calibration gas must be performed or the sensor must be calibrated.

Testing CO_2 Calibration With Calibration Gas

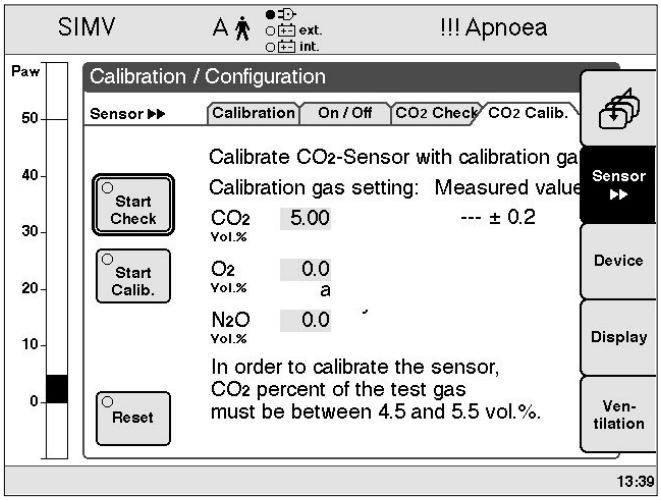
– if the specified calibration value was not met when testing with the test filter.

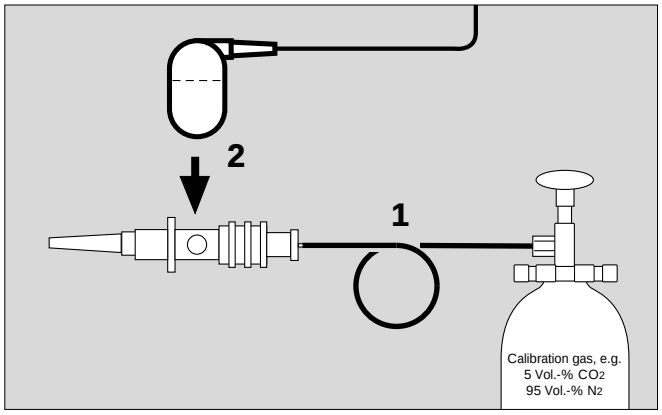
- Perform CO_2 calibration, see pages 11,12.

After the CO_2 calibration:

- Press »**Calib./Config.**« menu key.
- Using the »**Sensor ▶▶**« menu key, select »**CO_2 Calib.**« screen menu.

Display (example):





- Connect calibration gas supply.
  Use the cuvette from the calibration set!

1 Connect calibration gas cylinder and cuvette of the calibration set to the hose.

2 Remove CO_2 sensor from its park bracket and fit it on cuvette of the calibration set.

- Read CO_2, O_2 and N_2O concentrations (Vol.%) of calibration gas from the test cylinder.
- Select screen field for respective parameter
  = turn dial knob,
  activate = press dial knob
- Set concentration = turn dial knob,
  confirm = press dial knob

NOTE: If the calibration gas consists only of CO_2 and N_2, set O_2 and N_2O concentrations to 0.

- Select »**Start Calib.**« screen key = turn dial knob.
- Confirm »**Start Calib.**« = press dial knob.

The CO_2 concentration **FCO_2** is displayed on-screen.

After about 10 seconds, the value of FCO_2 must match the CO_2 content of the calibration gas within ±0.2 Vol.% .

If the calibration value is outside the permitted tolerance, the CO_2 sensor must be recalibrated with calibration gas.

- Push CO_2 sensor back onto cuvette.

Calibrating CO_2 Sensor

The CO_2 sensor must be calibrated:

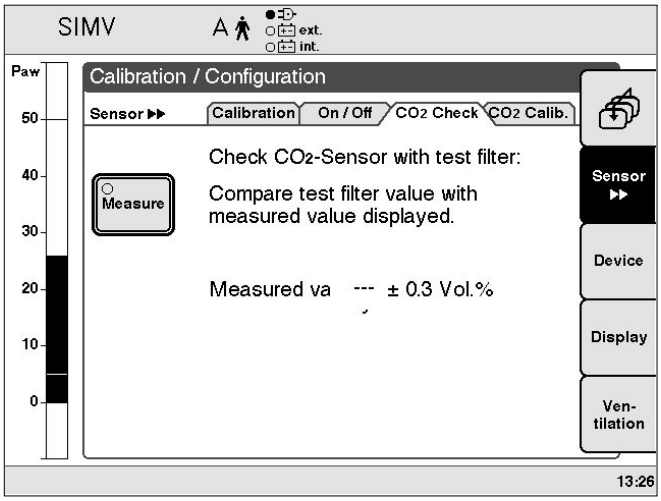
– if the specified calibration values are not met when checking calibration with filter or calibration gas.

- Perform CO_2 calibration, see pages 11,12.

After the CO_2 calibration:

- Press »**Calib. / Config.**« menu key.
- Using the »**Sensor ▶▶**« menu key, select »**CO_2 calib.**« menu page.

Display (example):

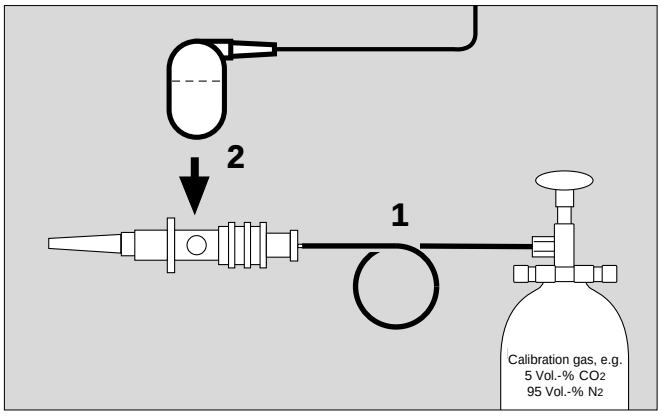


- Connect calibration gas supply.
  Use cuvette from the calibration set!

1 Connect calibration gas cylinder and cuvette of the calibration set to the hose.

2 Remove CO_2 sensor from its park bracket and fit it onto the calibration set cuvette.

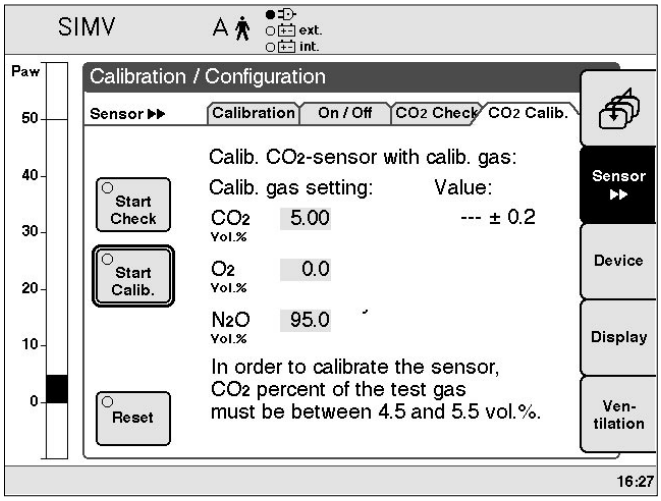
- Read CO_2, O_2 and N_2O concentrations (Vol.%) of calibration gas from test cylinder



- Select screen field for respective parameter
  = turn dial knob,
  activate = press dial knob
- Set concentration = turn dial knob,
  confirm = press dial knob

NOTE: If the calibration gas consists only of CO_2 and N_2, set O_2 and N_2O concentrations to 0.

- Select »**Start Calib.**« screen key = turn dial knob.
- Confirm start of calibration = press dial knob.



During calibration, the following message is displayed:

CO_2 calibration. Please wait

Evita 2 dura performs calibration and confirms with the message:

CO_2 calibration OK

Failed calibration is indicated by the ventilator with the message:

CO_2 calibration interrupted
or
CO_2 calibration not OK

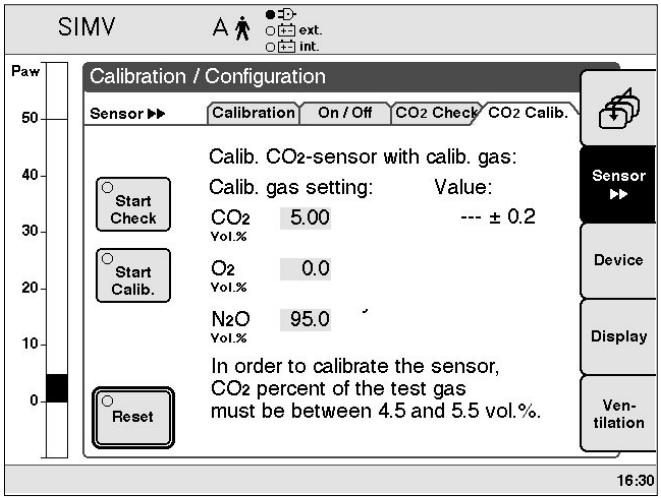
Calibration of the CO_2 sensor must then be repeated.

Resetting CO_2 Calibration

– If calibration with calibration gas proved unsuccessful, the factory default calibration value may temporarily be used.

- Press »**Calib. / Config.**« menu key.
- Using the »**Sensor ▶▶**« menu key, select »**CO_2 Calib.**« menu page.

Display (example):



- Select »**Reset**« screen key = turn dial knob.
- Reset calibration value = press dial knob.

After about 5 seconds, resetting is complete, and the factory set calibration value is reactivated.

Recover the correct calibration as soon as possible!

Care

Disassembly

Clean and process ventilator after each patient.

WARNING !

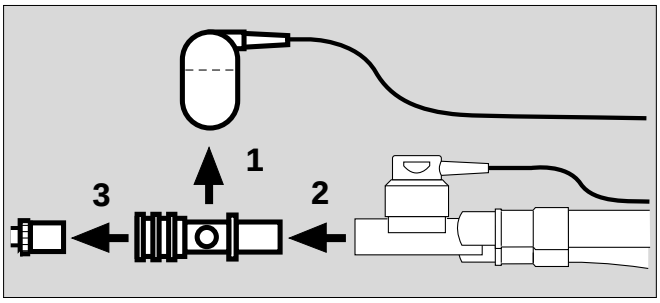
Always follow accepted hospital procedures for handling equipment contaminated with body fluids.

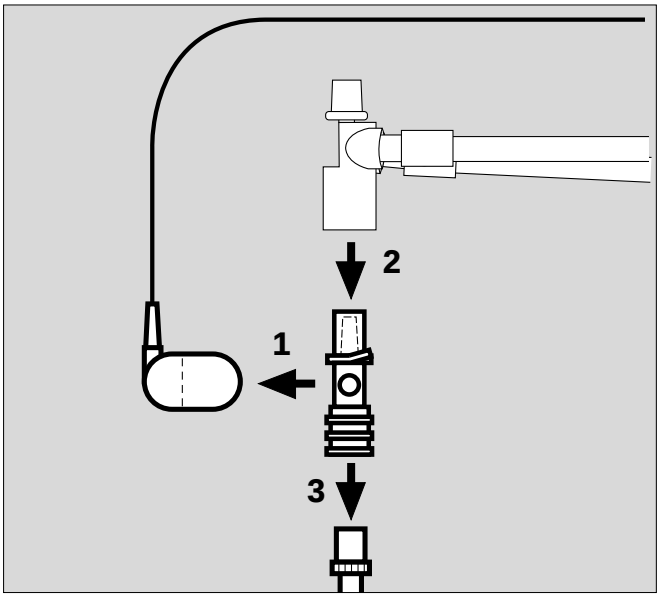
For both adult and pediatric sensor configurations:

1 Remove CO_2 sensor from cuvette
Unplug sensor connector on the rear panel of Evita 2 dura.

2 Detach CO_2 sensor cuvette from wye.

3 Remove ET-tube connector from cuvette.





Disinfecting / Cleaning

CAUTION !

Certain components of the ventilator and its accessories consist of materials that are sensitive to certain organic solvents sometimes used for cleaning and disinfec-ting (e.g., phenols, halogen releasing com-pounds, oxygen releasing compounds, strong organic acids, etc.). Exposure to such substan-ces may cause damage that is not always immediately recognized. Sterilization with ethylene oxide (EtO) is also not recommended.

To prevent any damage, we recommend that only detergents and disinfectants are used that are compatible with the device, e.g. surface disinfectants on the basis of aldehydes or quarternary ammonium compounds for disinfection.

Ensure that all disinfectants are registered with the U.S. Environmental Protection Agency for use as intended. Always follow the instruction labels specifically with respect to prescribed concentrations and the necessary exposure times.

Disinfectants often contain – besides their main active agents – additives that can also damage materials. If in doubt, ask the supplier/manufacturer of the disinfectant/ cleaning agent.

WARNING !

Follow all accepted hospital procedures for disinfecting parts contaminated by body fluids (protective clothing, eyewear, etc.).

CO_2 Cuvette

- Wipe off any obvious soiling with disposable tissue and cotton swabs, in particular inside and outside the windows.
- Disinfect in a moisture saturated environment at 93 °C (200 °F) for 10 minutes using a cleaning and disinfecting machine. **Use detergent only.**

  Or:

- Bath disinfect using a disinfectant based on the suggested active substances, e.g. Cidex, Johnson & Johnson

  Or:

- Steam-autoclave at 134 °C (273 °F).

CO_2 Sensor

- Wipe off any obvious soiling with cotton swabs, in particular on the windows of the CO_2 sensor.
- Wipe-disinfect, e.g. with 70% ethanol or a similar agent.

After processing

- Reinstall cuvette and CO2 sensor, see page 10.

Troubleshooting

Alarm messages in the alarm display field are displayed in hierarchical order.
If, for example, two faults are detected at the same time, the more urgent of the two is displayed.

The priority for alarm messages is indicated by exclamation marks:
Warning = Message with top priority **!!!**
Caution = Message with medium priority **!!**
Advisory = Message with low priority **!**

In the table below, the messages are listed in alphabetical order.
The table should help you to identify the cause of an alarm and to ensure rapid remedy of the problem.

Message		Cause	Remedy
CO_2 sensor	**!!!**	CO_2 sensor probe removed during operation.	Reinsert probe.
		CO_2 sensor not positioned on cuvette.	Place CO_2 sensor on cuvette.
		CO_2 sensor defective.	Replace defective CO_2 sensor.
Clean CO_2 cuvette	**!!!**	Cuvette window dirty. Sensor window dirty	Use a clean cuvette. Clean CO_2 sensor
CO_2 calibration?	**!!!**	Zero point out of tolerance.	Perform CO_2 calibration, pages 11,12.
CO_2 monitoring off	**!**	CO_2 monitoring is switched off.	Switch CO2 monitoring back on, see page 14 or immediately provide adequate external monitoring
		Calibration was not successful	Perform CO_2 calibration correctly, pages 11,12.
CO_2 measurement inop	**!!!**	CO_2 sensor defective.	Replace defective CO_2 sensor.
		CO_2 measurement defective.	Call DraegerService.
etCO_2 high	**!!!**	End-expiratory CO_2 concentration above upper alarm limit.	Check patient condition, check ventilation pattern, correct alarm limit if necessary.
etCO_2 low	**!!!**	End-expiratory CO_2 concentration below lower alarm limit.	Check patient condition, check ventilation pattern, correct alarm limit if necessary.

Maintenance

CAUTION !

Maintenance

In case of malfunction of this component, contact your local DraegerService or our Factory Authorized Technical Service Center.

The Evita 2 dura ventilator must be inspected and serviced (preventive maintenance) by competent and factory authorized technical service representatives at regular 6 month intervals. A record must be kept on this preventive maintenance. We recommend obtaining a service contract through your vendor.

Maintenance or repair of the Evita 2 dura ventilator shall be performed only by Draeger authorized technical service representatives.

WARNING !

To avoid any risk of infection, clean and disinfect ventilator and accessories before any maintenance according to established hospital procedures - this applies also when retur-ning ventilators or parts for repair.

WARNING !

Preventive Maintenance work on the Evita 2 dura ventilator and its components may be performed by trained and factory authorized staff only.

WARNING !

Never operate the ventilator if it has suffered physical damage or does not seem to operate properly. In this case always refer servicing to properly trained and factory authorized service personnel.

Maintenance Intervals

Preventive maintenance	Every 6 months by trained and factory authorized service personnel.

The Evita 2 dura CapnoPlus option is serviced as part of the scheduled preventive maintenance of the Evita 2 dura ventilator every six months.

Technical Data

Environmental conditions

During operation	
Temperature	10 to 40 °C (50 to 104 °F)
Atmospheric pressure	670 to 1200 hPa
Rel. humidity	10 to 100 % (no condensation)
During storage and transport	
Temperature	–10 to 60 °C (14 to 140 °F)
Atmospheric pressure	670 to 1200 hPa
Rel. humidity	10 to 100 % (no condensation)

Performance data

End-expiratory CO_2 concentration etCO_2	
Range	0 to 100 mmHg or 0 to 13.3 Vol.% or 0 to 13.3 kPa
Resolution	1 mmHg or 0.1 Vol.% or 0.1 kPa
Accuracy	
for 0 to 40 mmHg	±2 mmHg
for 40 to 100 mmHg	±5 % of measured value
$T_{10...90}$	≤ 25 ms
Warm-up time	max. 3 minutes
CO_2 production $\dot{V}CO_2$	
Range	0 to 999 mL/min, (STPD)*
Resolution	1 mL/min
Accuracy	±9 % of measured value
$T_{10...90}$	12 minutes
Serial dead space Vds	
Range	0 to 999 mL, (STPD)*
Resolution	0.1 mL
Accuracy	±10 % of measured value or ±10 mL, whichever is greater
Dead space ventilation Vds/VT	
Range	0 to 99 %
Resolution	1 %
Accuracy	±10 % of measured value

* STPD = Standard Temperature Pressure, Dry
Measured values referred to standard physical conditions: 0 °C, 1013 mbar, dry.

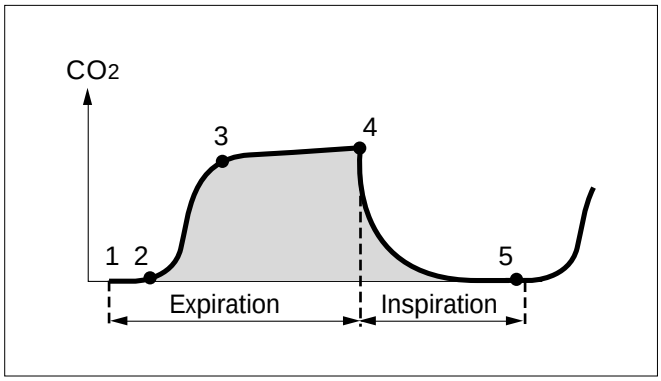
Dead space:	
including adult size cuvette	16 mL
including pediatric size cuvette	6 mL
Weight	
Sensor	30 g (1.1 oz.)
Cuvette	8 g (0.3 oz.)
Alarm at upper alarm limit for etCO_2	when upper threshold is exceeded
Setting range	1 to 100 mmHg or 0 to 15 kPa or 0 to 15 Vol.%
Factory-set default at start-up	60 mmHg
Alarm at lower alarm limit for etCO_2	when lower threshold is exceeded
Setting range	0 to 99 mmHg or 0 to 14.9 kPa or 0 to 14.9 Vol.%
Factory-set default at start-up	30 mmHg
Protection class	I, type BF
CO_2 sensor	type BF 

Materials:

CO_2 cuvette	polysulphone with glass windows
CO_2 sensor and cable	polyurethane

Theory of Operation

Physiological Capnogram



Waveform segment 1 - 2
Emptying upper airway deadspace

CO_2 concentration during this waveform segment is zero. This is the initial expiratory phase where the analyzed gas comes from the upper airways and the ET-tube and has not participated in alveolar gas exchange.

Waveform segment 2 - 3
Gas from lower airways and alveoli

CO_2 concentration shows a sharp rise because the analyzed gas partially comes from the lower airways and partially from CO_2-rich alveoli.

Waveform segment 3 - 4
Alveolar gas

This pase is called the "alveolar plateau".
CO_2 concentration increases only gradually. Analyzed gas is mostly from alveolar areas of the lung.

Time mark 4
endexpiratory CO_2 partial pressure

Marks the highest concentration of exhaled CO_2 and is reached at the end of expiration. This value is known as end-tidal CO_2 ($etCO_2$) and represents the last portion of gas that has participated in alveolar gas exchange.
In humans with healthy lungs, endexpiratory CO_2 partial pressure is, on average, 4 mmHg lower than arterial CO_2 pressure. It is therefore an indicator for CO_2 partial pressure in arterial blood.
The difference between CO2 partial pressure as measured arterially or in the endexpiratory gas can increase significantly in the presence of an impaired perfusion ventilation ratio.

Waveform segment 4 - 5
Inspiration

CO_2 concentration falls quickly as fresh, CO_2-free gas enters the airways.

---

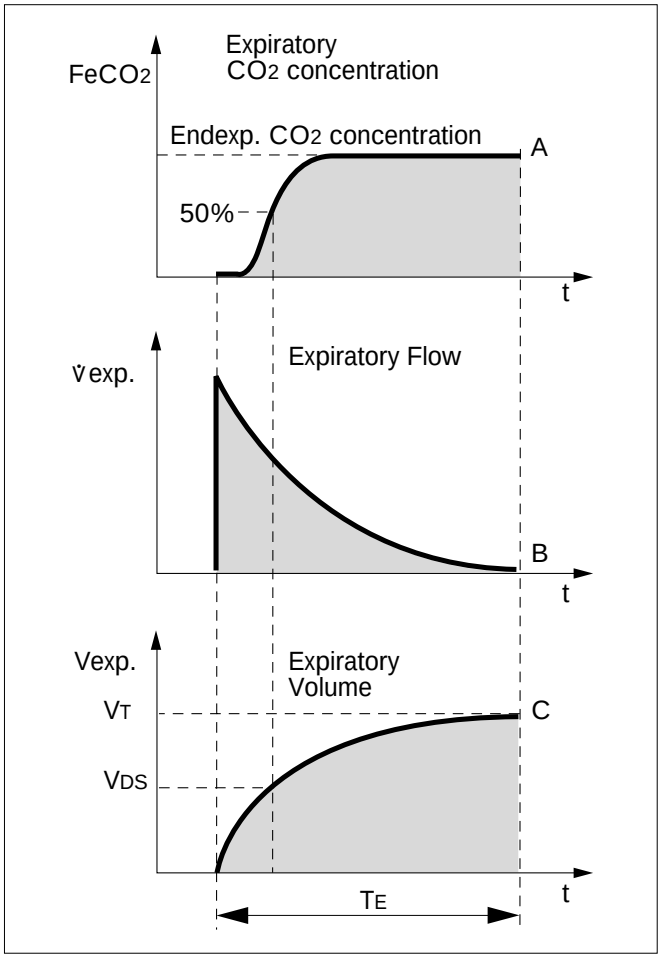
* J. Baum, Anaesthesiol. Reanimation. 16 (1991) No. 1. 12-22

Serial deadspace (V_{ds}) is the volume that is expired when expiratory CO_2 concentration has reached 50% of endexpiratory CO_2 concentration.

Dead space ventilation in % characterizes the ratio of serial deadspace to total expiratory tidal volume.

The calculated value of **CO_2 production ($\dot{v}CO_2$)** represents expired volume of CO_2 per minute. CO_2 production results from the integration of CO_2 concentration (trace A) multiplied with the simultaneously measured flow (trace B).

During expiration, CO_2 produced through a patient's metabolism is transported to the environment via pulmonic circulation and the lungs.
It is therefore that endexpiratory CO_2 concentration ($etCO_2$) and the **shape of the expiratory CO_2 waveform** (capnogram) provide rapid diagnostic information about all three areas (ventilation, perfusion, and metabolism).



Abbreviations Explained

BTPS	**B**ody **T**emperatur, **P**ressure, **S**aturated Measured values refer to conditions in a patient's lung, at body temperature of 37 °C, water vapor saturated gas, ambient pressure
etCO_2	Endexpiratoy CO_2 concentration
NN	height above sea level (m)
STPD	**S**tandard **T**emperature (0 °C), **P**ressure (1013 hPa), **D**ry (dry gas)
T_E	Expiratory time
T_I	Inspiratory time
$\dot{V}$ CO_2	CO_2-production L/min
Vexsp	Expiratory volume
V_{ds}	Serial deadspace
V_T	Tidal volume

Bibliography

J. Baum, Anaesthesiol. Reanimation. 16 (1991)
No. 1. 12-22

Ordering Information

Item/Description	Part No.
Evita 2 dura CapnoPlus™	
Capnography option for Evita 2 dura	84 13 780
Test filter	68 70 281
Calibration kit	84 12 710
Calibration gas cylinder 5 Vol.% CO_2 95 Vol.% N_2	68 50 435
Mainstream sensor	68 70 300
Park bracket for sensor	84 12 840
Replacement parts:	
Cuvette, adult size	68 70 279
Cuvette, pediatric size	68 70 280

Index

Abbreviations..... 29
Advisory..... 6
Alarm.....23
Alarm limits.....13

Bibliography..... 29

Capnogram..... 27
Care.....20
Caution..... 6
CO_2 calibration.....11
CO_2 calibration, checking with test filter..... 15
CO_2 calibration, checking with test gas..... 16
CO_2 calibration, reset.....19
CO_2 waveform, displaying..... 13
CO_2 waveform, configuring..... 11
CO_2, units of measurement..... 9
CO_2 sensor, installing.....10
CO_2 sensor, calibrating..... 18
Cuvette, installing..... 10

Disassembly.....20
Disinfecting/cleaning.....21

First use.....9

Intended use..... 8

Literature.....29

Monitoring function, switching off..... 12

Ordering information.....30

Preparation..... 9

Safety information.....4

Technical data..... 25
Testing/Calibrating.....15
Troubleshooting.....23

Warning..... 6

These Operating Instructions apply only to **Evita 2 dura** with Serial No.:

Without entry of a Serial No. by Draeger these Operating Instructions are provided for general information only and are not intended for use with a specific device.

Draeger Medical, Inc.
3136 Quarry Road
Telford, PA 18969
215-721-6910
FAX 215-721-6915

90 28 759 - GA 5664.804 enUS

2nd edition - November 1999
Subject to modifications